

Attorney Docket No. TS02-420

REMARKS/ARGUMENTS

Claims 1, 2, 5-23, and 25-28 were previously pending in this patent application and each of claims 1, 2, 5-23, and 25-28 has ostensibly been rejected (although the Office Action Summary lists claims 1, 2, 5-23, and 25 -26 as pending and "allowed").

- 5 Claims 12, 14, 23 and 27 are hereby amended. Applicants respectfully request re-examination, reconsideration and allowance of each of pending Claims 1, 2, 5-23, and 25 -28.

I. Claim Objections

- 10 On page 2 of the subject Office Action, claims 12 and 23 were objected-to due to informalities regarding "n and k values" Responsive to the claim objections, each of independent claims 12 and 23 has been amended to recite "n and k values for corresponding optical constants n and k." There is now sufficient antecedent basis for "n and k values" and n and k are defined as optical constants in the claim preambles and also in the specification.

- 15 The claim objections should therefore be withdrawn.

II. Claim Rejections under 35 U.S.C. § 103 and Applicant Comments regarding Response to Arguments

- 20 On page 3 of the subject Office Action, claims "1, 3-6, 8-12, 14-17 and 19-28" were rejected under 35 U.S.C. § 103(a) as being unpathable over Prior Art of Present Invention, hereinafter "PAPI", in view of Pinaton et. al. (US Patent No. 6,141,103), hereinafter "Pinaton". Applicants understand the rejections to apply to claims "1, 5-6, 8-12, 14-17, 19-23 and 25-28" and solicit the Examiner's clarification if Applicants' understanding is incorrect. Applicants respectfully submit that these claim rejections are overcome for reasons set forth below.

- 25 Claims 1, 12 and 23 represent the independent claims of the claims rejected under 35 U.S.C. § 103 and each of independent claims 1, 12 and 23 recites distinguishing features neither disclosed nor suggested in the PAPI or Pinaton. Both the PAPI and the Pinaton reference teach computing a thickness and other values

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based upon measurements using spectroscopic (spectral) ellipsometry and other measurements.

In contrast, each of independent claims 1, 12 and 23 recites the features of:

- 5 performing a spectral ellipsometer measurement and a broadband spectrometer measurement of said [top photoresist¹/organic or inorganic²] layer in an integrated optical measurement system; and
- 10 independent of said performing, determining a thickness for said [top photoresist³/organic or inorganic⁴] layer using an independent optical thickness measurement component based on Beam Profile Reflectometry or Beam Profile Ellipsometry.

In other words, the thickness of the [organic or inorganic layer] of claim 1 or the [top photoresist layer] of claims 12 and 23, is determined using an independent optical

15 thickness measurement based on Beam Profile Reflectometry or Beam Profile Ellipsometry and independent of performing the spectral ellipsometer measurement and broadband spectrometer measurement of the layer in question. The PAPI does not disclose this feature. The only thickness determination of the PAPI is a product of a combination of measurements including a spectral (spectroscopic) ellipsometer

20 measurement. The Office action apparently concedes as much on page 3, paragraph (c), which indicates "independent of said performing, determining a thickness substrate . . . by a fit model data to experimental data . . . and a modeling of film stack information", clearly comparing and contrasting the "determining a thickness" step of the claimed invention to the different practices disclosed in the PAPI.

¹ Claims 12 and 23

² Claim 1

³ Claims 12 and 23

⁴ Claim 1

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The PAPI discloses obtaining measurement data including spectroscopic ellipsometry data - SE measurement as in reference No. 31 of FIG. 6, and then weighing this spectral ellipsometer measurement along with other factors, using an assumed film thickness and approximated n and k values and then computing a thickness therefrom using a complicated series of iterations that initially require an assumed file thickness supplied by the engineer, as shown in features 32 and 36 of Figure 6 of the present application. The originally filed specification then states, on page 5, lines 13-17 "fitting of experimental data to modeling data in step 36 may involve several iterations of changing the model input until a best fit of modeling data to experimental data is obtained in step 37. Once a best fit is achieved, the program provides values for n, k, and thickness simultaneously." The shortcoming of this procedure is also described in the originally filed specification on page 5, lines 17-20 which reads "Unfortunately, the accuracy of the n and k values are strongly dependent on the application engineer's experience. A wrong initial guess for the regression fitting in the modeling phase will turn out erroneous n and k values and unreliable mapping signatures".

The advantage provided by the claimed feature of independently determining the thickness, is that the experimental data output 50 (referring to Figure 7) is closer to the modeled data and therefore the fitting of the data that takes place at steps 53, 54 and 55 of Figure 7 takes place more quickly and provides an improvement in accuracy compared to the prior art. Table 1 of the specification provides such an example of the improvement in accuracy.

The PAPI does not provide the feature of determining thickness using an independent optical thickness measurement component based on Beam Profile Reflectometry or Beam Profile Ellipsometry, i.e., independent of the spectral ellipsometer measurements and broadband spectrometer measurements, as in the claimed invention. (Neither does Pinaton.)

Pinaton has been relied upon for providing a computation unit 26 for determining thickness of an organic or inorganic layer but does not make up for the above-stated

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deficiencies of the PAPI. In particular, Pinaton discloses that "The present invention is based upon a measurement by spectroscopic ellipsometry of the thickness and refractive index", col. 3, lines 30-32 and provides Figure 2 which provides all of the measurements being analyzed in computation unit 26. Pinaton, too, derives thickness
5 from spectroscopic ellipsometry unlike the claimed invention of claims 1, 12 and 23.

Independent claims 1, 12 and 23 are therefore each distinguished from the Prior Art of Present Invention and Pinaton, and therefore the rejection of these claims under 35 U.S.C. § 103, should be withdrawn. Claims 5, 6, and 8-11 ultimately depend from claim 1, claims 14-17 and 19-22 ultimately depend from claim 12, and claims 25-28
10 ultimately depend from claim 23. As such, the rejection of claims 1, 5-6, 8-12, 14-17 19-23 and 25-28 under 35 U.S.C. § 103(a) as being unpatentable over the PAPI in view of Pinaton, should be withdrawn.

***Dependent Claims 2 and 13**

On page 9 of the Office Action, claims 2 and 13 were rejected under 35 U.S.C
15 § 103 (a) as being unpatentable over PAPI in view of Pinaton and further in view of Coates et. al. (U.S. Patent No. 4,826,321), hereinafter "Coates". Applicants respectfully submit that these claim rejections are overcome for reasons set forth below.

Claims 2 and 13 depend from claims 1 and 12 respectively, each of which is distinguished from the reference of Pinaton in view of the PAPI. The secondary
20 reference of Coates has apparently been relied upon for providing measuring thin film thickness of a layer having the range of about 10 to 1500 angstroms and does not make up for the above-stated deficiencies of the PAPI and Pinaton. Claims 1 and 12 are therefore distinguished from the PAPI in view of Pinaton and Coates and because dependent claims 2 and 13 each incorporate the distinguishing features of their base
25 claims, claims 2 and 13 are similarly distinguished. Therefore, the rejection of claims 2 and 13 under 35 U.S.C. § 103(a), should be withdrawn.

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***Dependent Claims 7 and 8**

On page 9 of the subject Office Action, claims 7 and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the PAPI in view of Pinaton and further in view of Opsal et. al. (U.S. Patent No. 6,671,047), hereinafter "Opsal". Applicants
5 respectfully submit that these claim rejections are overcome for reasons set forth below.

Claims 7 and 18 depend from claims 1 and 12, respectively, which are each distinguished from the references of Pinaton and the PAPI for reasons set forth above. Opsal has apparently been relied upon for teaching that it is known in the art to provide a critical point model otherwise as known as a harmonic oscillator approximation. Such
10 does not make up for the above-stated deficiencies of the PAPI and Pinaton and therefore claims 1 and 12, and dependent claims 7 and 18, are distinguished from the PAPI in view of Pinaton and Opsal. As such, the rejection of claims 7 and 18 under 35 U.S.C. § 103(a) should be withdrawn.

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CONCLUSION

Based on the foregoing, each of pending claims 1-2, 5-23 and 25-28 is in allowable form and the application in condition for allowance, which action is respectfully and expeditiously requested.

5 The Assistant Commissioner for Patents is hereby authorized to charge any fees or credit any excess payment that may be associated with this communication to Deposit Account 04-1679.

Respectfully submitted,

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